Final Report

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Survey of Durum Production Practices

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Summary

Durum growers were surveyed in cooperation with the USDA's National Agricultural Statistics Service to determine production practices and their effects on yield and protein in the 2006 growing season. The survey was conducted in two regions: West (Yuma and La Paz counties) and Central (Maricopa, Pinal, and Pima counties). These two regions represent about 95% of the durum acreage. We obtained responses from 85 out of an estimated 170 durum growers (50%) representing 40,580 out of 70,000 acres (58%). Durum was grown following vegetables (42%), cotton (41%), lettuce (12%), or other crops. The predominant soil texture was a sandy clay loam (47%), followed by sandy loam (30%) and clay loam (16%). Herbicide was applied on 52% of the acreage. The major varieties were Kronos (26%), Ocotillo (20%), Alamo (16%), and Orita (16%). Flood irrigation systems accounted for 87% of the acreage, followed by furrow (11%). The crop was typically irrigated 6 times. The average planting date (irrigation applied) was December 27 in the Central region and January 4 in the West region. The seed was planted at an average rate of 160 lbs/acre. Phosphorus was applied to only a quarter of the acreage, but when it was applied, the rate averaged 65 lbs P_2O_5/acre. Nitrogen rate averaged 224 lbs N/acre. Increased yield was associated with previous crops other than cotton in the West region, certain varieties, lack of herbicide application, planting in January in the West region and November or December in the Central region, a seeding rate between 100 and 160 lbs N per acre, and an N rate between 200 and 300 lbs N per acre. Increased grain protein was associated with a previous crop of vegetables or lettuce in the West region, lack of herbicide application in the Central region, manure application, clay loam or sandy clay loam soil, December planting in the West region, lack of phosphorus application, and fewer irrigations. This survey documents associations, not cause-and-effect relationships, among durum production practices, yield, and protein.

Introduction

Research on agricultural practices has traditionally been done in small plots by varying one aspect of management, called the treatment, and keeping all else constant. Clear conclusions can be drawn using this approach, but the applicability of the results is limited to the specific location and set of growing conditions. A method of conducting research that allows wider applicability of results is to correlate agricultural practices and yield from a large number of fields. The question is often asked how the top producers obtain high grain yield and protein. The problem with this approach is the accuracy of the information provided and the fact that correlation does not establish a cause-and-effect relationship. Nevertheless, some useful knowledge may be gained using survey methodology.

Procedures

A survey of durum production practices in 2006 was developed and sent to growers in two regions of Arizona: West (Yuma and La Paz counties) and Central (Maricopa, Pinal, and Pima counties). These two regions contained

about 70,000 of the 74,000 acres of durum in the state in 2006, or about 95% of the durum acreage. We obtained responses from 85 out of an estimated 170 durum growers (50%) representing 40,580 out of 70,000 acres (58%). The information requested on the survey included town, previous crop, variety, herbicide applied, insecticide applied, PGR applied, manure or compost applied, irrigation system, soil texture, planting date, seeding rate, fertilizer application, and number of irrigations applied. The survey responses were statistically analyzed using analysis of variance.

Results and Discussion

Durum acreage in 2006 was roughly split between the West (56%) and Central (44%) regions, and grain yield was higher in the West region (Table 1). The county with the greatest percentage of the acreage was Yuma (50%) followed by Pinal (23%) and Maricopa (17%). Grain yield was highest in Yuma and Pinal Counties, and grain protein was not different among counties.

Durum was most often planted after vegetables (42%), cotton (41%) or lettuce (12%). The highest yields and protein in the West region were obtained after vegetables or lettuce.

The top four varieties in terms of percentage of acreage were Kronos (26%), Ocotillo (20%), Alamo (16%), and Orita (16%). Several varieties were grown in both regions, but some such as Alamo were predominantly grown in the West region and others such as Ocotillo were predominantly grown in the Central region. Of the top 4 varieties mentioned above, both yield and protein were highest in Alamo in the West and Kronos in the Central region. However, there were other varieties that were not grown as widely that had either higher yield or protein.

Herbicide was applied to most of the acreage in the West region, whereas most of the acreage in the Central region did not receive a herbicide application. Grain yield and protein (in the Central region) was slightly higher in the when herbicide was not applied. Insecticide was only applied to 1% of the acreage. Plant growth regulator (PGR) to control lodging was applied to less than 1% of the acreage. Manure or compost was applied to 14% of the acreage overall, and was associated with higher protein in the West region.

The predominant irrigation system is border flood (73%) followed by level basin (14%) and furrow (11%). Grain protein was higher in the border compared to level basin system. I believe there may be some confusion among the respondents about the definition of border flood and level basin irrigation, so these results may not be representative.

Durum was grown predominantly on sandy clay loam soil (47%) followed by sandy loam (30%) and clay loam (16%) soil. Grain protein was lower on sandy loam soil compared with clay loam and sandy clay loam.

The average planting date was January 4 in the West region and December 27 in the Central region. The highest yields were obtained with a January planting date in the West region and November or December planting date in the Central region. Higher grain protein was obtained with earlier planting dates in the West region.

The average seeding rate was 160 lbs seed/acre. Highest yields were reported for seeding rates between 100 and 159 lbs seed per acre.

The average nitrogen rate was 224 lbs N/acre. The highest grain yield was associated with nitrogen rates between 200 – 299 lbs N/acre. The response of the durum crop to nitrogen fertilizer depends on several factors that were not included in this survey, such as initial soil nitrogen content.

Only about a quarter of the durum acreage received P fertilizer, but a higher percentage of the acreage in the Central region received P fertilizer than in the West region presumably due to adequate soil P in the West from vegetable production. When P fertilizer was applied, the average phosphorus rate was 65 lbs P_2O_5/acre. Application of P fertilizer in the Central region was associated with lower grain protein, but again, response to P fertilizer is also influenced by other factors, such as soil P.

The average number of irrigations applied was 6.2. The number of irrigations applied was not associated with yield, but there was a weak trend for higher protein with fewer irrigations in the West.

This survey has shown that there are some associations between the various durum production practices and grain yield and protein, but these associations do not imply a cause-and-effect relationship. Side by side comparisons are the best way to evaluate the direct effect of varieties, fertilizer rates, or irrigation practices. Nevertheless, increased yield was associated with previous crops other than cotton in the West region, certain varieties, lack of herbicide application, planting in January in the West region and November or December in the Central region, a seeding rate between 100 and 160 lbs N per acre, and an N rate between 200 and 300 lbs N per acre. Increased grain protein was associated with a previous crop of vegetables or lettuce in the West region, lack or herbicide application in the Central region, manure application, clay loam or sandy clay loam soil, December planting in the West region, lack of phosphorus application, and fewer irrigations.

Acknowledgements

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Table 1. Number of survey respondents (N), grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz Co.)				Central (Maricopa, Pinal, and Pima Co.)				All (West and Central)			
	N	Yield	Protein	Acres	N	Yield	Protein	Acres	N	Yield	Protein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
Region												
West	38	6392	13.4	56	.	.	.	.	38	6392	13.4	56
Central	.	.	.	.	47	5898	13.3	44	47	5898	13.3	44
Significance		---	---			---	---			*	*NS*	
County												
Yuma	33	6506	13.4	50	.	.	.	.	33	6506	13.4	50
Pinal	.	.	.	.	25	6197	13.5	23	25	6197	13.5	23
Maricopa	.	.	.	.	15	5507	13.2	17	15	5507	13.2	17
La Paz	5	5640	13.5	6	.	.	.	.	5	5640	13.5	6
Pima	.	.	.	.	7	5666	12.8	4	7	5666	12.8	4
Significance		*	*NS*			+	*NS*			**	*NS*	
Previous crop												
Vegetables	20	6434	13.4	38	1	5180	12.5	4	21	6375	13.3	42
Cotton	5	5940	12.9	6	40	5983	13.3	35	45	5978	13.2	41
Lettuce	12	6627	13.5	12	.	.	.	.	12	6627	13.5	12
Durum	.	.	.	.	3	4400	14	4	3	4400	14	4
Chile	.	.	.	.	1	8000	13	1	1	8000	13	1
Sorghum	.	.	.	.	1	4500	12.3	1	1	4500	12.3	1
Alfalfa	.	.	.	.	1	7000	13	0	1	7000	13	0
Corn	1	5000	14.5	0	.	.	.	.	1	5000	14.5	0
Significance		+	+			**	*NS*			**	*NS*	
Variety												
Kronos	9	6194	13.2	16	9	6912	13.4	10	18	6553	13.3	26
Ocotillo	.	.	.	0	17	5866	13.4	20	17	5866	13.4	20
Alamo	8	6769	13.6	16	.	.	.	0	8	6769	13.6	16
Orita	5	6460	12.9	7	6	5497	13.3	9	11	5935	13.1	16
WPB881	4	5874	13.4	7	1	4500	12.3	1	5	5599	13.2	8
Kofa	4	6225	13.8	4	.	.	.	0	4	6225	13.8	4
Sky	.	.	.	1	6	5877	12.8	2	6	5877	12.8	3
Duraking	3	7033	13.3	2	.	.	.	0	3	7033	13.3	2
Crown	.	.	.	0	4	5100	13.7	2	4	5100	13.7	2
Havasu	1	6400	13.4	1	.	.	.	0	1	6400	13.4	1
Matt	.	.	.	0	1	6000	.	1	1	6000	.	1
Reva	1	8600	.	1	.	.	.	0	1	8600	.	1
RoyalII	1	5000	14.5	0	.	.	.	0	1	5000	14.5	0
BR0202W	1	4220	13.7	0	.	.	.	0	1	4220	13.7	0
Significance		*	**			**	+			+	**	

Table 1 (Con'd). Number of survey respondents, grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz Co.)				Central (Maricopa, Pinal, and Pima Co.)				All (West and Central)			
	N	Yield	Protein	Acres	N	Yield	Protein	Acres	N	Yield	Protein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
Herbicide applied												
No	10	6572	13.4	10	39	6058	13.4	38	49	6163	13.4	48
Yes	28	6328	13.4	45	8	5115	12.7	7	36	6059	13.2	52
Significance		*	*NS*			*	+			*	*NS*	
Insecticide applied												
No	37	6430	13.4	56	46	5910	13.3	43	83	6142	13.3	99
Yes	1	5000	14.5	0	1	5318	12	1	2	5159	13.3	1
Significance		*NS*	*NS*			*NS*	+			+	**	
PGR applied												
No	37	6451	13.4	56	47	5898	13.3	44	84	6141	13.3	100
Yes	1	4220	13.7	0	.	.	.	.	1	4220	13.7	0
Significance		*	*NS*			---	---			+	*NS*	
Manure or compost applied												
No	35	6383	13.3	52	34	5959	13.2	35	69	6174	13.3	86
Yes	3	6501	14	4	13	5738	13.4	10	16	5881	13.5	14
Significance		*NS*	**			*NS*	*NS*			*NS*	*	
Irrigation system												
Border	28	6276	13.5	42	29	5862	13.3	31	57	6066	13.4	73
Level basin	9	6686	12.9	12	4	6377	13.3	2	13	6591	13	14
Furrow	.	.	.	.	14	5834	13.2	11	14	5834	13.2	11
Sprinkler	1	7002	14	2	.	.	.	.	1	7002	14	2
Significance		*NS*	**			*NS*	*			*NS*	*NS*	
Soil texture												
Sandy clay loam	16	6506	13.5	34	13	5557	13.1	13	29	6080	13.3	47
Sandy loam	13	6534	13.2	12	25	5895	13.3	18	38	6113	13.3	30
Clay loam	7	6225	13.3	9	6	6580	13.6	7	13	6389	13.4	16
Sand	.	.	.	.	1	6000	12.9	5	1	6000	12.9	5
Silt loam	1	5000	14.5	0	1	6508	13.1	1	2	5754	13.8	1
Silty clay loam	.	.	.	.	1	5600	13	1	1	5600	13	1
Clay	1	5300	13	0	.	.	.	.	1	5300	13	0
Significance		*NS*	*			*NS*	+			*NS*	*NS*	

Table 1 (Con'd). Number of survey respondents, grain yield, grain protein, and percentage of acres represented by various durum production practices in Arizona.

	West (Yuma and La Paz Co.)				Central (Maricopa, Pinal, and Pima Co.)				All (West and Central)			
	N	Yield	Protein	Acres	N	Yield	Protein	Acres	N	Yield	Protein	Acres
		lbs/a	%	%		lbs/a	%	%		lbs/a	%	%
Planting date												
November	1	6400	14	2	3	6167	13	5	4	6225	13.3	7
December	17	6399	13.5	12	28	6154	13.3	29	45	6246	13.4	41
January	17	6526	13.3	40	10	5196	13.2	8	27	6033	13.2	48
February	3	5600	13.2	2	3	5206	12.8	2	6	5403	13	3
Significance		+	**			+	NS			+	NS	
Seeding rate (lbs/a)												
100-119	2	8100	14.5	1	2	5659	12	1	4	6880	13.3	2
120-139	10	6458	13.3	8	5	6080	13.3	4	15	6332	13.3	11
140-159	8	6428	13.3	25	12	6165	13.4	12	20	6270	13.4	38
160-179	12	6210	13.3	11	11	5709	13.5	11	23	5970	13.4	22
180-200	6	6033	13.5	10	17	5805	13.1	17	23	5865	13.2	27
Significance		*NS*	*NS*			+	*NS*			**	*	
Nitrogen rate (lbs N/a)												
0-99	3	7200	14.2	2	6	5133	13.4	4	9	5822	13.7	6
100-199	13	6274	13.3	16	10	5264	13.1	14	23	5835	13.2	30
200-299	12	6716	13.4	21	23	6454	13.1	20	35	6544	13.2	40
300-499	9	5983	13.3	17	8	5663	13.6	6	17	5832	13.5	23
Significance		+	**			**	*NS*			+	*NS*	
Phosphorus applied												
No	28	6272	13.5	47	27	5755	13.3	28	55	6018	13.4	76
Yes	10	6730	13	8	20	6091	13.2	16	30	6304	13.1	24
Significance		*NS*	**			*NS*	+			*NS*	*NS*	
Number of irrigations												
<6	13	6695	13.5	13	20	5606	13.2	16	33	6035	13.4	29
6	13	6465	13.4	29	11	5917	13.5	9	24	6214	13.5	37
7	7	6158	13.2	7	6	6548	13.4	5	13	6338	13.3	13
>7	5	5744	13.4	6	10	6070	12.9	14	15	5961	13.1	21
Significance		*NS*	*			*NS*	*NS*			*NS*	*NS*	
All	38	6392	13.4	56	47	5898	13.3	44	85	6119	13.3	100

Significance: Statistical significance or probability that differences observed are due to chance. NS = not significant at the 10% probability level, + = significant at the 10% probability level, * = significant at the 5% probability level, and ** = significant at the 1% probability level.